

ASSOCIATIONS OF LUNG CANCER MORTALITY WITH LONG-TERM EXPOSURE TO PM_{2.5} COMPONENTS

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Background and Aims: Numerous epidemiological studies have now documented that long-term exposure to fine particulate matter air pollution mass (PM_{2.5}) is associated with an increased risk of mortality. The ACS study has found associations of PM_{2.5} with increased risk of lung cancer mortality, but the types of particles that are most related to these associations have not been investigated. The focus of this new research was to determine which components of PM_{2.5} mass were most explanatory of the previously reported PM_{2.5} association with lung cancer mortality.

Methods: Using the ACS cohort (extended through 2004), and the U.S. EPA PM_{2.5} Speciation data, we evaluated mortality associations between various composition and source components of PM_{2.5} in 100 U.S. metropolitan areas. Source apportionments were conducted using methods by Thurston and Spengler (1982). Individual elements were also considered as exposure indices. Mortality analyses employed Cox Proportional Hazards modeling.

Results: The major U.S. PM_{2.5} sources identified, their key tracer elements, and their mean nationwide PM_{2.5} impacts were: Metals (Pb, Zn) 0.2 $\mu\text{g}/\text{m}^3$; Soil (Ca, Si) 0.8 $\mu\text{g}/\text{m}^3$; Traffic (OC, EC, NO₂) 4.6 $\mu\text{g}/\text{m}^3$; Steel (Fe, Mn) <0.1 $\mu\text{g}/\text{m}^3$; Coal Combustion (As, Se, S) 1.1 $\mu\text{g}/\text{m}^3$; Oil Combustion (V, Ni) 0.9 $\mu\text{g}/\text{m}^3$; Salt (Na, Cl) 0.1 $\mu\text{g}/\text{m}^3$; Biomass burning 1.3 $\mu\text{g}/\text{m}^3$; Other Sulfates (S) 4.3 $\mu\text{g}/\text{m}^3$; Other Nitrates (NO₃) 0.6 $\mu\text{g}/\text{m}^3$; and, Other Organic Carbon (OC) 0.6 $\mu\text{g}/\text{m}^3$. Coal combustion-related PM_{2.5} and its key trace elements were most strongly associated with lung cancer PM_{2.5}-mortality associations.

Conclusions: Particles resulting from the combustion of fossil fuels, especially coal, are most associated with increased risk of lung cancer mortality from long-term PM_{2.5} exposure.

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